

IV.—On the Systematic Position of the Genus *Mycetobia*, Mg. (Diptera Nematocera). By F. W. EDWARDS, B.A., F.E.S.

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FOR many years the small gnats of the genus *Mycetobia* have been a great puzzle to all Dipterists who have attempted to arrive at a natural classification of the order, owing to the fact that the adults appear to diverge very slightly in structure from typical members of the MYCETOPHILIDÆ, while, on the other hand, the larvæ differ little, if at all, from those of the family RHYPHIDÆ*, which has always been regarded as widely separated from the MYCETOPHILIDÆ.

Osten-Sacken, the foremost Dipterist of the last century, thus states the problem (Berl. ent. Zeit. vol. xxxvii. p. 442): " . . . I have shown the perfect unity of type prevailing among the larvæ of the different genera of this family. There is one exception to this rule, however. . . . It is the larva of *Mycetobia pallipes*, which is not peripneustic, like the larvæ of the other MYCETOPHILIDÆ, but amphipneustic; it shows the most remarkable resemblance to the larva of *Rhyphus*, and often occurs together with it. Three trustworthy observers have described the larvæ as amphipneustic: Lyonet, Dufour, and Perris. The two latter have found the larva together with that of *Rhyphus*, and were struck by their resemblance, although fully aware of the differences. . . . If there is a real relationship between the larvæ of *Mycetobia* and *Rhyphus*, we have a right to expect a corresponding relationship among the imagos. But, as this relationship does not exist, this is a problem yet to solve."

In spite of the high standing of the observers quoted by Osten-Sacken, a recent writer (Knab, Ann. Ent. Soc. Amer., March 1915, p. 95) has got over the difficulty by suggesting " that the supposed difference rests upon an error of observation." That this is not the case, however, has recently been found by Mons. D. Keilin, whose studies (as yet unpublished) have not only confirmed the observations of the early authors †, but have shown that the resemblance between the larvæ of *Mycetobia* and *Rhyphus* is even greater than they supposed.

* Throughout this paper the term *Rhyphus* has been used, though strictly, according to the rules of priority, it should be replaced by *Anisopus*.

† The main facts were also confirmed by Johannsen in 1910 ('Maine Agricultural Experiment Station, Bulletin 177').

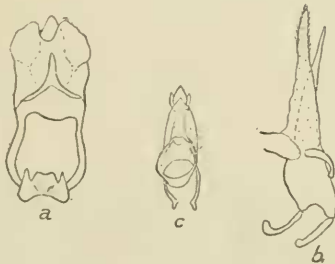
At M. Keilin's suggestion, I have devoted some study to the adult structure of the MYCETOPHILIDÆ and RHYPHIDÆ, in order to ascertain whether any characters can be found to support conclusions based on the study of larvæ and pupæ. Without claiming to have made at all an exhaustive investigation, I think I may safely state not only that such characters do exist, but that they should be taken into account in the classification of the Diptera as a whole.

In order to explain clearly what these characters are, it will be necessary to give a brief comparative account of the structure of the mouth-parts and the venation in the two families in question. In referring to the mouth-parts of the MYCETOPHILIDÆ I am relying partly on my own observations, but chiefly on the excellent work lately published by Dr. R. Frey (Acta Soc. Fauna et Flora Fennica, xxxvii. no. 2, 1913).

MOUTH-PARTS.

Mandibles.—There seems to be no trace of these in either of the two families.

Fig. 1.



Labrum, epipharynx, and hypopharynx of (a) *Olbiogaster africanus*, Edw., (b) *Rhyphus fenestralis*, Scop., and (c) *Mycetobia pallipes*, Mg.

Labrum.—In both the MYCETOPHILIDÆ and RHYPHIDÆ the labrum is very much reduced, being, as a rule, almost entirely membranous. There is, nevertheless, a considerable amount of variation. In the Rhyphid genus *Olbiogaster* a distinct chitinized piece is present on the upper side, the lower side (the so-called epipharynx) being chiefly membranous; in *Rhyphus* the upper side is membranous, the lower side more or less chitinized and provided with a fringe of hairs towards the tip; in *Mycetobia* the whole labrum is membranous.

Hypopharynx (fig. 1. p. 109).—Frey has found that in most MYCETOPHILIDÆ, as also in SCIARIDÆ and CECIDOMYIIDÆ, the hypopharynx is but poorly developed, and is fused on to the upper surface of the labium. The only exception he noted was in the genus *Bolitophila*, in which the hypopharynx is free at the tip; he had not, however, examined a large number of forms, and *Mycetobia* was not among them—it has the hypopharynx very well developed and entirely free from the labium, being connected rather with the labrum. *Rhyphus* and *Olbiogaster* likewise have a free hypopharynx, though its form is very diverse in the three genera. In *Mycetobia* it is trilobed at the tip, the middle lobe having a finely toothed margin; in *Olbiogaster* it is simple, and also in *Rhyphus*, though in the last-named genus it is straighter and more pointed. It is connected with the “pharyngeal pump,” which seems to be rather better developed in *Mycetobia* than in other MYCETOPHILIDÆ, and is even more conspicuous in the RHYPHIDÆ.

Maxille (fig. 2).—In both families the parts of the maxillæ present are stipes, galea, and palpus. The stipites are apparently absent in *Ditomyia* (fig. 4 a) and perhaps in *Macrocera*; small in *Platyura* (fig. 4 b); well developed in the other genera, attaining their greatest size in the more typical MYCETOPHILIDÆ, such as *Phronia* (see fig. 4 d), *Erechia*, and *Mycetophila*. In these last-mentioned forms the galea or blade of the maxilla is very much reduced, but in the more primitive MYCETOPHILIDÆ and in the RHYPHIDÆ it is quite large.

The maxillary palpi of *Rhyphus* are four-jointed (without reckoning the small basal palpiger, which may be a true joint). The second joint is somewhat enlarged, and contains a peculiar gland provided with a duct which opens by a pore at the tip of the joint. *Olbiogaster* has similar palpi, but the joints differ in their relative lengths, and the duct of the gland in the second joint is shorter; the palpiger has more the appearance of a true joint. In *Mycetobia* the palpi are only three-jointed, but, as the basal joint contains a gland very similar to that of *Rhyphus*, it is probably safe to assume that the palpi have become three-jointed by the fusion of the first two. In both genera the penultimate joint is roundish, the terminal one more elongate. Many MYCETOPHILIDÆ possess a structure in the second palpal joint which is, perhaps, comparable with the gland above referred to; but in no other case that I have observed is this gland provided with a duct, nor does it (except in the case of *Simulium*,

where it is well developed) appear to possess any opening to the exterior.

Labium (fig. 2).—The homologies of the different parts of the labium are still very uncertain. The structures usually

Fig. 2.

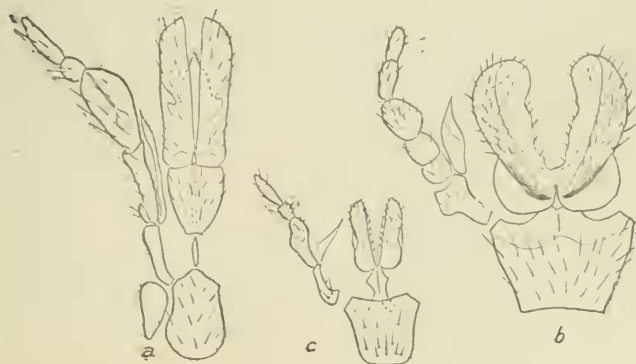


Fig. 3.

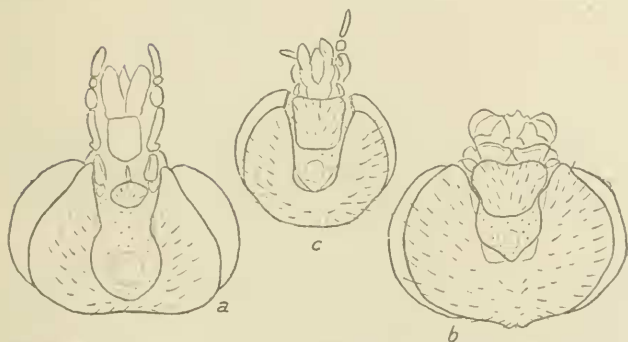


Fig. 2.—Maxilla and labium of (a) *Rhyphus fenestralis*, Scop., (b) *Olbogaster africanus*, Edw., and (c) *Mycetobia pallipes*, Mg.

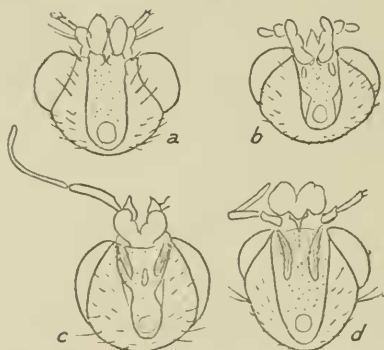
Fig. 3.—Under surface of head of (a) *Rhyphus punctatus*, Fabr., (b) *Olbogaster africanus*, Edw., (c) *Mycetobia pallipes*, Mg. Note the large hairy gular plate.

known as labella in Diptera are regarded by Kellogg and others as being paraglossæ, by Frey as representing the labial palpi. The piece to which they are attached is

described by Kellogg simply as the "basal labial sclerite"; Frey homologizes it with the mentum. I am by no means certain that Frey's view is correct, since it usually shows a median groove or suture, indicating that it may have arisen by the fusion of paired structures. For convenience, however, it may be well to follow Frey.

In MYCETOPHILIDÆ the labium consists of the two large labella, usually two-jointed, attached to the mentum, at the base of which an ill-defined submentum is sometimes discernible. *Mycetobia* differs from all the other MYCETOPHILIDÆ* in possessing at the base of the labium a large hairy gular plate (figs. 2 c and 3 c) covering the forked end

Fig. 4.



Under surface of head of (a) *Ditomyia fasciata*, Mg., (b) *Platytura nemoralis*, Mg., (c) *Empalia vitripennis*, Mg., (d) *Phronia forcipula*, Winn. Note absence of gular plate, except in c; also great development of the maxillary stipites in c and d.

of the mentum†; to the anterior angles of this plate are attached the bases of the maxillary stipites. The only other Mycetophilid in which I have found any gular plate at all is *Empalia vitripennis*; in this case the plate is very small, bears no hairs, and is quite remote from the labium (fig. 4 c).

* I have examined from this point of view the following species:—*Diadocidia ferruginosa*, *Ditomyia fasciata*, *Symmerus annulatus*, *Bolitophila cinerea*, *Macrocera stigma*, *Platytura fasciata*, *P. nemoralis*, *Mycomyia inscisurata*, *Sciophila hirta*, *Empalia vitripennis*, *Tetragoncura sylvatica*, *Allactoneura cineta*, *Boletina sciarina*, *Docosia valida*, *Leiomomyia subfasciata*, *Phronia forcipula*, *Erechhia fungorum*, and *Mycetophila punctata*.

† It is possible that this "gular plate" is really the true mentum, which in that case is absent in the other MYCETOPHILIDÆ.

at, and the following points of resemblance between the two genera become more apparent:—(1) the radial sector forks basally to the R-M cross-vein, or, in other words, the small cross-vein is situated on the third longitudinal vein, instead of on the præfurca; (2) the lower branch of the cubitus is distinctly sinuous, the cell Cu_1 having a convexity on the lower side towards the base. The resemblance between the venation of *Mycetobia* (fig. 5 a) and *Olbiogaster* (fig. 5 b) is in some respects still more marked, and it is worthy of particular notice that in *Olbiogaster africanus*, Edw., and still more conspicuously in *O. sackeni*, Edw., the lowest of the three veins arising from the discal cell (M_3) is less strongly chitinized than the other two, suggesting that the venation of *Mycetobia* has arisen directly from that of *Olbiogaster* through the obsolescence of M_3 .

In almost all other MYCETOPHILIDÆ the radial sector, when it forks at all, does so nearer the wing-apex than the position of the R-M cross-vein, which, besides, is usually sloping, and not straight as it is in *Mycetobia*. The only exception to this rule is the genus *Pachyneura*, in which the radial sector forks exactly at the R-M cross-vein. In all other MYCETOPHILIDÆ, with the exception of *Leiomylia* (*Glaphyoptera*) and its allies, the cell Cu_1 is concave instead of convex on its lower margin. *Ditomyia* and *Symmerus*, genera which, together with *Mycetobia*, have been made to form the subfamily MYCETOBIINÆ, agree in both these respects with the other MYCETOPHILIDÆ, and I therefore consider that they are not at all closely related to *Mycetobia*. The genus *Mesochria*, recently described from the Seychelles Islands, is, on the other hand, closely related to *Mycetobia*. Its venation is very interesting, as the media is evanescent; it evidently represents a further stage of evolution from *Mycetobia*, in which the lowest branch of the originally three-branched media has already disappeared.

A comparison with other Diptera as regards the position of the radial fork reveals the fact that in the Tipulidæ, Culicidæ, Psychodidæ, Orthorrhapha Brachycera, and Cyclorrhapha it always takes place anteriorly to the R-M cross-vein, whereas in the Chironomidæ, Simulidæ, and Bibionidæ the radial sector is usually simple, but when it forks does so beyond the R-M cross-vein. An apparent exception to this rule, however, is the Bibionid genus *Eupeitenus*. It is also noteworthy that in the families of the first group the media is primitively three-branched, while in those of the second it is never more than two-branched.

OTHER CHARACTERS.

As regards the other characters—those of the thorax, abdomen, and legs,—not much need be said. *Rhyphus* is peculiar in having holoptic eyes in the male and greatly enlarged empodia; it does not, however, share either of these characters with *Obiogaster*, which resembles the MYCETOPHILIDÆ rather than *Rhyphus* in both these respects.

Of the male genitalia, which usually provide sound indications of relationship, I have made no comparative study; but it is noteworthy that *Mycetobia* appears to be the only MYCETOPHILID which possesses chitinous spermathecae in the female. Of these, there are two in *Mycetobia*, two (or, perhaps, three) in *Obiogaster*, one in *Rhyphus*.

CONCLUSIONS.

1. *Mycetobia* agrees with the RHYPHIDÆ and diverges from the MYCETOPHILIDÆ in the possession of a large gular plate, in the structure of the second palpal joint, in the position of the forking of the radial vein, the course of the cubital vein, and in the chitinous spermathecae of the female. Since the venation of *Mycetobia* has been shown to be directly derivable from that of the Rhyphid genus *Obiogaster*, it is probable that any resemblances in this respect to the MYCETOPHILIDÆ are due to convergent evolution, and not to relationship. The genus *Mycetobia* (and with it *Mesochria*, though not *Ditomyia* or *Symmerus*) must therefore, on grounds of adult as well as larval structure, be transferred from the MYCETOPHILIDÆ to the RHYPHIDÆ.

2. It is at least possible that the characters of the gular plate and of the position of the radial fork will be found on full investigation to divide the Nematocera into two groups, and there is evidence that these groups may coincide with those founded on other characters, notably the tracheal system of the larva; this evidence, therefore, tends to confirm Knab's recent division of the Nematocera (Ann. Ent. Soc. Amer. vol. viii. p. 93, March 1915) into OLIGONEURA, with peripneustic larvæ, and POLYNEURA, with amphipneustic larvæ. The genus *Pachyneura* seems to require special study, owing to the intermediate character of its venation, and *Eupeitenus* is also aberrant.

3. If, as seems probable from many considerations, the higher Diptera have been derived from the POLYNEURA and the OLIGONEURA represent an entirely distinct line of evolution,

the primary division of the order should be neither into ORTHORRHAPHIA and CYCLORRHAPHIA, nor into NEMATOCERA and BRACHYCERA, but into POLYNEURA and OLIGONEURA, the former including, in addition to the Tipulid-Culicid group of the NEMATOCERA, the whole of the CYCLORRHAPHIA and the ORTHORRHAPHIA BRACHYCERA.

V.—Notes on *Fossorial Hymenoptera*.—XIX. On new Species from Australia. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Family Mutillidæ.

Ephutomorpha submetallescens, sp. n.

♀. Cærulescens; abdomine pedibusque cupreo-purpureis; antennis nigris; mandibulis nigris, basi ferrugineis; segmentis dorsalibus 1-5 macula apicali albo-hirta.

Long. 12 mm.

♀. Head distinctly narrower than the thorax, closely and rather coarsely punctured, not much narrowed behind the eyes, rather strongly rounded posteriorly; eyes large, as near to the posterior margin of the head as to the base of the mandibles; antennal tubercles well developed, second joint of the flagellum as long as the first and third combined. Thorax very coarsely reticulate, nearly twice as long as the greatest breadth, a little broader in the middle than on the anterior margin, the apical third rather strongly narrowed. Abdomen closely punctured, the punctures on the second dorsal segment larger than on the others and more or less confluent; first segment oblique from near the apex to the base, slightly constricted at the apex, with a spine on each side at the base beneath and with a small patch of white hairs at the apex; second dorsal segment very long, more than half as long again as the greatest breadth, narrower at the extremities. No pygidial area. The sides of the apical segments clothed with long black hairs. Intermediate and hind tibiæ without spines on the outer margin. Calcaria white, the outer apical angle of the tibiæ produced into two short spines much less than half the length of the calcaria.

Hab. Brisbane (*Hacker*); February.

This is very nearly related to *E. metallica*, Sm., but